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10/807,190	03/24/2004	Takeshi Yamamoto	57810-091	3715

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EXAMINER	
TRINH, THANH TRUC	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/807,190	YAMAMOTO ET AL.	
	Examiner	Art Unit	
	Thanh-Truc Trinh	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 September 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

1. Claims 1-3, 5-8 and 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kataoka et al. (US Patent 6133522) in view of Kloppel et al. (PGPub 20030170449).

Regarding claims 1, 5-7 and 10-11, as seen in Figure 5, Kataoka et al. disclose a photovoltaic device comprising a photovoltaic element including a transparent conductive oxide film 504, and a paste electrode 505, wherein the paste electrode containing a metal material (Ag or silver) and a resin material (epoxy). (See col. 9 lines 10-29). The resin material can contains 100% epoxy

resin, therefore it meets the limitation of "at least about 60 percent by weight and not more than about 100 percent by weight of epoxy resin". The transparent conductive oxide film 504 is made of ITO, or SnO_2-In_2O_3. (See col. 9 lines 1-9). Kataoka et al. also teach a copper tab or a tin foil (506a) attaching to the paste electrode 505. (See col. 9 lines 30-37 or col. 14 lines 37-47). It is the Examiner's position that the copper tab or tin foil is an electric wire.

Kataoka et al. do not explicitly teach the transparent conductive oxide film having an arithmetic mean deviation of the profile (or mean surface roughness Ra) of not more than about 2 nm, nor do they teach the mean surface roughness is ranged from 0.5 nm to not more than about 1 nm.

Kloppel et al. teach the transparent conductive oxide film of ITO having an arithmetic mean deviation of the profile (or surface roughness) of less than 1 nm. (See paragraph [0013]). Applicant's disclosure states that "the contact angle of water on the surface of the ITO film is at least about 40° and not more than about 74° when the arithmetic mean deviation of the profile (Ra) of the ITO film is in the range of at least 0.5 nm to not more than about 2 nm" (Specification, page 35 line 23 – Page 36 line 8 and Figure 8). As the surface roughness of transparent conductive oxide film (ITO) in the range of less than 1 nm and, the Examiner considers that the contact angle of water with respect to the surface of the transparent conductive oxide film is at least about 40° and not more than about 74°.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify to device of Kataoka et al. by having the surface roughness of ITO less than 1 nm as taught by Kloppel et al., because it would avoid spikes, thereby enhancing conductivity and adhesion. (See paragraph [0005]-[0006]).

Regarding claims 2-3, as seen in Figure 5 and Example 1, Kataoka et al. further describe the photovoltaic element further comprising a first conductivity type crystalline semiconductor layer (p-type microcrystalline Si); an intrinsic non-single crystalline semiconductor layer (i-type a-Si) wherein the transparent conductive oxide (504) is formed on the non-single-crystalline semiconductor layer, a second conductivity type non-single-crystalline semiconductor layer (n-type a-Si) formed on the intrinsic non-single-crystalline and the transparent conductive oxide film is formed on the second conductivity type non-single-crystalline semiconductor layer. (See col. 14 lines 17-47)

Regarding claim 8, Kloppel et al. teach the content of indium oxide in the ITO is 90% and that of the tin oxide is 10% (See paragraphs 0008 or 0027). It was found that the content of Sn in the transparent conductive oxide film is about 5% by weight.

2. Claims 4 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kataoka et al. (US Patent 6133522) in view of Kloppel et al.

(PGPub 20030170449) and further in view of Morizane et al. (PGPub 20010045505).

Regarding claim 4, Kataoka et al. and Kloppel et al. disclose a photovoltaic device as described in claim 2. Kataoka et al. further disclose the intrinsic non-single-crystalline semiconductor layer (i-type a-Si) includes first and second intrinsic non-single-crystalline semiconductor formed on the upper and lower surfaces of the first conductivity type crystalline semiconductor (p-type μc-Si), respectively. Kataoka et al. also describe a second conductivity type non-single crystalline (n-type a-Si) formed on the upper surface of the first intrinsic non-single-crystalline semiconductor layer, and the transparent conductive oxide film formed on the upper surface of the second conductivity type non-single-crystalline semiconductor layer. (See Figure 5 and col. 14 lines 17-47)

Kataoka et al. and Kloppel et al. do not teach the first conductivity type non-single-crystalline semiconductor formed on the lower surface of the second intrinsic non-crystalline semiconductor layer, nor do they teach the transparent conductive oxide film includes a second transparent conductive oxide film formed on the lower surface of the fourth non-single-crystalline semiconductor layer.

Morizane et al. teach a second first conductivity type non-single crystalline semiconductor (16) formed on the lower surface of the second intrinsic non-single-crystalline semiconductor (15), and a second transparent conductive oxide (17) film formed on the lower surface of the first conductivity type non-single-crystalline semiconductor layer. (See Figure 1 and paragraph [0052]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Kataoka et al. and Kloppel et al. by having a second transparent conductive oxide film as taught by Morizane et al., because it would reduce defects on the interface, improve characteristics of the heterojunction interface and enable light to enter from both front and rear surfaces of the device. (See paragraphs [0051]-[0052]).

Regarding claim 12, Kataoka et al. and Kloppel et al. disclose a photovoltaic device as described in claim 1. Kataoka et al. describe a plurality of the photovoltaic elements provided at a prescribed interval and connected in series by electric wires (copper tab and tin foil), wherein the photovoltaic element includes a first paste electrode formed on the upper surface of photovoltaic element. (See Figures 1 and 5, col. 14 lines 37-47).

Kataoka et al. and Kloppel et al. do not teach a second paste electrode formed on the lower surface of the photovoltaic element.

Morizane et al. teach using a second collector electrode (18). (See Figure 1 and paragraph [0052])

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Kataoka et a. and Kloppel et al. by utilizing the second collector electrode as taught by Morizane et al., because it would enable light to enter from both front and rear surfaces. (See paragraph [0051]). In such combination, it would certainly have been obvious that

the second collector electrode can be a paste collector electrode like the first collector electrode 505 of Kataoka et al.

It also would have been obvious to one having ordinary skill in the art at the time the invention was made to connect the first end of the electric wire (copper tab or tin foil) to the first paste electrode of one cell and the second end of the electric wire to the second paste electrode of another cell as taught by Morizane et al., because in this way the photovoltaic elements are connected in series as taught by Kataoka et al.

3. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kataoka et al. (US Patent 6133522) in view of Kloppel et al. (PGPub 20030170449) and further in view of Kitae et al. (PGPub 20010005053).

Regarding claim 9, Kataoka et al. and Kloppel et al. disclose a photovoltaic device as described in claim 1.

Kataoka et al. and Kloppel et al. do not teach the paste electrode containing urethane resin in addition to the epoxy resin.

Kitae et al. teach providing urethane resin in addition to the epoxy resin in the paste electrode. (See paragraph [0071]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Kataoka et al. and Kloppel et al. by utilizing urethane resin as taught by Kitae et al., because it would increase adhesion strength. (See paragraph [0076]).

4. Claims 13-15, 17-19, 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kataoka et al. (US Patent 6133522) in view of Kloppel et al. (PGPub 20030170449).

Regarding claims 13, 17-18 and 21, as seen in Figure 5, Kataoka et al. disclose a photovoltaic device comprising a photovoltaic element including a transparent conductive oxide film 504, and a paste electrode 505, wherein the paste electrode containing a metal material (Ag or silver) and a resin material (epoxy). (See col. 9 lines 10-29). The resin material can contains 100% epoxy resin, therefore it meets the limitation of "at least 60 percent by weight and not more than about 100 percent by weight of epoxy resin". The transparent conductive oxide film 504 is made of ITO, or SnO_2-In_2O_3. (See col. 9 lines 1-9). Kataoka et al. also teach a tin foil (506a) attaching to the paste electrode 505. (See col. 9 lines 30-37 or col. 14 lines 37-47). It is the Examiner's position that the copper tab or tin foil is an electric wire.

Kataoka et al. do not explicitly teach the transparent conductive oxide provided with a surface having contact angle of at least about 40° and not more than about 74° with respect to water.

Kloppel et al. teach the transparent conductive oxide film of ITO having a surface roughness of less than 1 nm (See paragraph [0013]). Applicant's disclosure states that "the contact angle of water on the surface of the ITO film is at least about 40° and not more than about 74° when the arithmetic mean

deviation of the profile (Ra) of the ITO film is in the range of at least 0.5 nm to not more than about 2 nm" (Specification, Page 35 line 23 – Page 36 line 8 and Figure 8). As the surface roughness of transparent conductive oxide (ITO) film reduces to less than 1 nm, the Examiner considers that the contact angle of water with respect to the surface of the transparent conductive oxide film is at least about 40° and not more than about 74°.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify to device of Kataoka et al. by providing a surface with contact angle of water from 40° to not more than about 74° as taught by Kloppel et al., because it would avoid spikes, thereby enhancing conductivity and adhesion. (See paragraph [0005]-[0006]).

Regarding claims 14-15, as seen in Figure 5 and Example 1, Kataoka et al. further describe the photovoltaic element further comprising a first conductivity type crystalline semiconductor layer (p-type microcrystalline Si); an intrinsic non-single crystalline semiconductor layer (i-type a-Si) wherein the transparent conductive oxide (504) is formed on the non-single-crystalline semiconductor layer, a second conductivity type non-single-crystalline semiconductor layer (n-type a-Si) formed on the intrinsic non-single-crystalline and the transparent conductive oxide film is formed on the second conductivity type non-single-crystalline semiconductor layer. (See col. 14 lines 17-47)

Regarding claim 8, Kloppel et al. teach the content of indium oxide in the ITO is 90% and that of the tin oxide is 10% (See paragraphs 0008 or 0027). It was found that the content of Sn in the transparent conductive oxide film is about 5% by weight.

5. Claims 16 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kataoka et al. (US Patent 6133522) in view of Kloppel et al. (PGPub 20030170449) and further in view of Morizane et al. (PGPub 20010045505).

Regarding claim 16, Kataoka et al. and Kloppel et al. disclose a photovoltaic device as described in claim 14. Kataoka et al. further disclose the intrinsic non-single-crystalline semiconductor layer (i-type a-Si) includes first and second intrinsic non-single-crystalline semiconductor formed on the upper and lower surfaces of the first conductivity type crystalline semiconductor (p-type μc-Si), respectively. Kataoka et al. also describe a second conductivity type non-single crystalline (n-type a-Si) formed on the upper surface of the first intrinsic non-single-crystalline semiconductor layer, and the transparent conductive oxide film formed on the upper surface of the second conductivity type non-single-crystalline semiconductor layer. (See Figure 5 and col. 14 lines 17-47)

Kataoka et al. and Kloppel et al. do not teach the first conductivity type non-single-crystalline semiconductor formed on the lower surface of the second intrinsic non-crystalline semiconductor layer, nor do they teach the transparent

conductive oxide film includes a second transparent conductive oxide film formed on the lower surface of the fourth non-single-crystalline semiconductor layer.

Morizane et al. teach a second first conductivity type non-single crystalline semiconductor (16) formed on the lower surface of the second intrinsic non-single-crystalline semiconductor (15), and a second transparent conductive oxide (17) film formed on the lower surface of the first conductivity type non-single-crystalline semiconductor layer. (See Figure 1 and paragraph [0052]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Kataoka et al. and Kloppel et al. by having a second transparent conductive oxide film as taught by Morizane et al., because it would reduce defective on the interface, improve characteristics of the heterojunction interface and enable light to enter from both front and rear surfaces of the device. (See paragraphs [0051]-[0052]).

Regarding claim 22, Kataoka et al. and Kloppel et al. disclose a photovoltaic device as described in claim 13. Kataoka et al. describe a plurality of the photovoltaic elements provided at a prescribed interval and connected in series by electric wires (copper tab and tin foil), wherein the photovoltaic element includes a first paste electrode formed on the upper surface of photovoltaic element. (See Figures 1 and 5, col. 14 lines 37-47).

Kataoka et al. and Kloppel et al. do not teach a second paste electrode formed on the lower surface of the photovoltaic element.

Morizane et al. teach using a second collector electrode (18). (See Figure 1 and paragraph [0052]))

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Kataoka et a. and Kloppel et al. by utilizing the second colllector electrode as taught by Morizane et al., because it would enable light to enter from both front and rear surfaces. (See paragraph [0051]). In such combination, it would certainly have been obvious that the second collector electrode can be a paste collector electrode like the first collector electrode 505 of Kataoka et al.

It also would have been obvious to one having ordinary skill in the art at the time the invention was made to connect the first end of the electric wire (copper tab or tin foil) to the first paste electrode and the second end of the electric wire to the second paste electrode as taught by Morizane et al., because in this way the photovoltaic elements are connected in series as taught by Kataoka et al.

6. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kataoka et al. (US Patent 6133522) in view of Kloppel et al. (PGPub 20030170449) and further in view of Kitae et al. (PGPub 20010005053).

Regarding claim 20, Kataoka et al. and Kloppel et al. disclose a photovoltaic device as described in claim 13.

Kataoka et al. and Kloppel et al. do not teach the paste electrode containing urethane resin in addition to the epoxy resin.

Kitae et al. teach containing urethane resin in addition to the epoxy resin in the paste electrode. (See paragraph [0071]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Kataoka et al. and Kloppel et al. by utilizing urethane in the resin as taught by Kitae et al., because it would increase adhesion strength. (See paragraph [0076]).

Response to Arguments

Applicant's arguments filed 9/18/2007 have been fully considered but they are not persuasive.

Applicant argues Kloppel discloses a film with very high specific resistance. Applicant also argues the high resistance of the Kloppel film is not useful in the photovoltaic element. However, applicant's argument is irrelevant. First of all, there is nothing in the claim language referring to a specific resistance. Kloppel discloses an ITO film with low specific resistance (see paragraph 0006 of Kloppel), which is also depending on the cross section area and the length of the layer, not a "high resistance" as the applicant referring to. Secondly, Kataoka et al. discloses a photovoltaic device using ITO as the transparent conductive electrode (See col. 9 lines 1-9 of Kataoka et al.) and Kloppel teaches using an ITO layer as a transparent conductive film. Therefore, the combination of Kataoka et al. and Kloppel is proper.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh-Truc Trinh whose telephone number is 571-272-6594. The examiner can normally be reached on 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

TT
6/10/2007

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